

REPORT DOCUMENTATION PAGE

AFRL-SR-BL-TR-00-

Public reporting burden for this collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, reviewing the collection of information, sending comments regarding this burden estimate or any other aspect of this collection of information, in Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington, VA 22202-4302, and to the Office of Management and

ating and
rate for

1. AGENCY USE ONLY (Leave blank)		2. REPORT DATE	3. REPORT TYPE AND DATES COVERED Final 15 Mar 97 to 29 Sep 99
4. TITLE AND SUBTITLE (DURIP-97) A Vacuum apparatus for investigating cathode activity and beam formation in high current density electron guns			5. FUNDING NUMBERS 61103D 3484/US
6. AUTHOR(S) Professor Paterson			
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) Stanford Junior University 651 Serra Street Room 260 Stanford CA 94305-4125			8. PERFORMING ORGANIZATION REPORT NUMBER
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES) AFOSR/NE 801 N Randolph Street Rm 732 Arlington, VA 22203-1977			10. SPONSORING/MONITORING AGENCY REPORT NUMBER F49620-97-1-0191
11. SUPPLEMENTARY NOTES			
12a. DISTRIBUTION AVAILABILITY STATEMENT APPROVAL FOR PUBLIC RELEASE, DISTRIBUTION UNLIMITED			12b. DISTRIBUTION CODE
13. ABSTRACT (Maximum 200 words) The Lambda Physics LPX 210 excimer laser is currently being installed in the oxide cathode laboratory. Its primary purpose is to produce a plasma that is deposited on a nickel cathode base. In this capacity it replaces a completely unreliable vacuum arc plasma gun. The laser will be used to produce emission coatings for high performance oxide cathodes.			
14. SUBJECT TERMS			15. NUMBER OF PAGES
			16. PRICE CODE
17. SECURITY CLASSIFICATION OF REPORT UNCLASSIFIED	18. SECURITY CLASSIFICATION OF THIS PAGE UNCLASSIFIED	19. SECURITY CLASSIFICATION OF ABSTRACT UNCLASSIFIED	20. LIMITATION OF ABSTRACT UL

20000503 103

Final Technical Report
Defense University Instrumentation Research Program

Grant Number F49620-97-1-0191

**A Vacuum Apparatus for Investigating Cathode Activity
and Beam Formation in High Current Density Electron Guns**

Sponsored by
Air Force Office of Scientific Research/NE

Program Manager
Dr Robert J. Barker
AFOSR/NE
801 North Randolph St., Rm. 732
Arlington, VA 22203-1977

Final Technical Report

The equipment purchased with the 1997 DURIP contract # F49620-97-1-0191 is listed below.

Equipment and Vendor	Cost
Excimer Laser Lambda Physik	\$109,549
Barium and Strontium Cathode Assemblies for Plasma Deposition ACI Alloys	\$9742
Latitude CPI Computer Dell Computer	\$4,856
Microway Screamer Workstation Microway	\$7,863

The total cost of the above items is \$132,010.

The Lambda Physik LPX 210 excimer laser is currently being installed in the oxide cathode laboratory. Its primary purpose is to produce a plasma that is deposited on a nickel cathode base. In this capacity it replaces a completely unreliable vacuum arc plasma gun. The laser will be used to produce emission coatings for high performance oxide cathodes. Coatings of barium and strontium deposited in an oxygen atmosphere will produce a low work function emission surface. Given the very clean environment in the deposition chamber and the absence of binders or other contaminants in the deposition process, the resulting cathodes are expected to have emission densities in excess of 100 A/cm².

The laser will also be used to deposit metalization on the surface of high performance ceramics. Very high purity alumina ceramics are very difficult to metalize. Using a laser plasma deposition process, metalization of a variety of technical ceramics should be possible. Success would make available a wide range of technical ceramics for use in microwave tubes.

RF breakdown studies have suggested that treatment of high gradient surfaces with a laser beam may significantly increase the threshold field for breakdown. The laser will be used to modify the surface characteristics of RF breakdown electrodes. If the results are successful, the laser treatment may replace many hours of conditioning that are normally required to process a high gradient component.

7

The cathode deposition experiment uses metallic barium and strontium in the plasma gun to produce the emission layer. Both these materials decompose when exposed to water vapor. In order to use the metallic barium it was necessary to design a very thin nickel sleeve to seal the metal surfaces from exposure to water. The barium and strontium cathode assemblies were used in the plasma gun deposition process and will continue to be used in the laser deposition experiments.

Both the computers are used in the modeling and simulation of RF components and RF-beam interactions in klystrons. The Microway Alpha based workstation is also used to run ANSYS 3-D thermal and stress analysis simulations for the microwave tubes and components.

The support of the US Air Force is greatly appreciated. The above equipment is critical to the research on microwave sources currently being conducted at Stanford.